

SOUND LEVEL IMPACT ASSESSMENT

Barfoots of Botley Limited
Sefter Farm
Pagham Road
Pagham
Bognor Regis
West Sussex
PO21 3PX



July 2021

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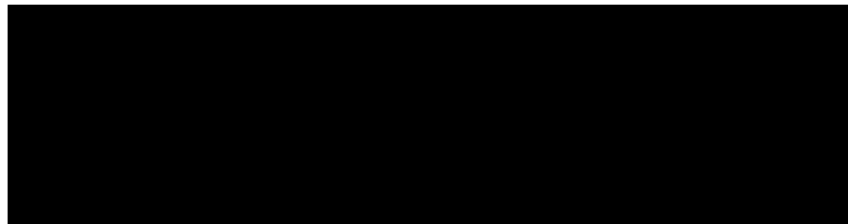
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Company information



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1 Introduction

A sound level assessment has been requested in support of the proposed alterations relating to the existing commercial use of the site as a nursery.

More specifically, a new packhouse is to be constructed to the east of the existing packing shed, on land currently in use as an open field. In doing so, this will now bring the existing yard eastwards also, and enclose it between the existing packhouse and proposed packhouse. In addition to this, the site parking area will be moved northeastwards, closer to Pagham Road and the site entrance

It is not expected for the alterations to result in a greater number of heavy vehicle movements, in and out of the site, although there may be more on-site movement involving light vehicles.

The objective of this assessment is to determine the current general noise levels within the areas where most vehicular activity occurs, so that the data can be used for any future projections.

2 Relevant guidance

2.1 Arun District Council Local Plan: 2011 - 2031

In undertaking this assessment the Arun District Council (CDC) Local Plan has been referred to, in which the following is deemed to have some relevance:

Policy QE DM1 - Paragraph 2 states that developers proposing new noise generating development must seek advice from an early stage to determine the level of noise assessment required. Proposals will need to be supported by:

- a. Evidence to demonstrate that there are no suitable alternative locations for the development.
- b. A noise report which provides accurate information about the existing noise environment, and the likely impact of the proposed development upon the noise environment. The report must also demonstrate that the development meets appropriate national and local standards for noise, as set out in Annex 1 of the Planning Noise Advice Document: Sussex, and any mitigation measures required to ensure noise is managed to an acceptable level.

- c. Evidence to demonstrate that the development will not impact upon areas identified and valued for their tranquillity, including Gaps Between Settlements which are important to the enjoyment of Arun's countryside, its habitats and biodiversity.

Paragraph 21.2.9 of the Plan states that... *'where new noise generating development such as industrial and commercial and outdoor sport and recreation uses are proposed, it is expected that they will be located at an appropriate distance away from noise sensitive development, ie. Residential areas, schools and hospitals. If the development is likely to cause unacceptable levels of disturbance, the developer should consider alternative locations for the site'.*

Paragraph 21.2.10 of the Plan states that... *'if there are no alternative sites available then the applicant will need to demonstrate that all steps have been taken to reduce noise at source. Finally, if all reasonable steps have been taken to reduce the noise at source, but the development is still likely to have adverse effects, then adequate measure to mitigate against the noise should be put in place to protect the noise sensitive use. This could include consideration of noise barriers and site layout first, then insulation of buildings as a last resort'.*

2.2 NPPF

Since the revocation of Planning Policy Guidance 24 (PPG24), the National Planning Policy Framework (NPPF) has been introduced - and subsequently revised most recently in July 2021. This document provides some general guidance to local authorities on considering the impact of noise in planning and policy decisions.

There is no direct guidance provided on acoustic criteria in the NPPF, therefore other more prescriptive documents have been referred to, as detailed below.

Reference is however made to the following:

- *Paragraph 130 Sub-section (c)* similarly implies that any development should be sympathetic to the local environment;
- *Paragraph 174 Sub-section (e)* which states that existing development should not be put at risk from unacceptable levels of noise pollution; and
- *Paragraph 185 Sub-sections (a) and (b)* state that noise impacts should be mitigated or reduced to a minimum to avoid impacting health of the quality of life, and that tranquil areas which have remained relatively undisturbed by noise should be protected.

2.3 British Standard 7445-1:2003

Part 1 of the British Standard 7445-1:2003 defines the basic quantities required for the description of noise in community environments and describes procedures for the determination of these quantities.

It provides guidance on the positioning of instrumentation including the distance from the exposed building and the preferred height of the microphone as well as detailing measurements to be taken during preferable meteorological conditions.

2.4 British Standard 8233:2014

British Standard 8233:2014 has reviewed and amended the former 1999 Standard. As before, it sets out guidance on desirable internal ambient noise levels for dwellings. Table 1 below summarises the recommended acoustic design criteria for a dwelling.

Table 1 BS 8233:2014 desirable acoustic design criteria for good standard

Location	Internal noise level	
	Daytime	Night time
Living room	35dB L _{Aeq} , (16hr)	-
Dining room	40dB L _{Aeq} , (16hr)	-
Bedroom	35dB L _{Aeq} , (16hr)	30dB L _{Aeq} , (8hr)

It is therefore generally recommended that for a dwelling, acceptable internal noise levels during the daytime should not exceed 35dB L_{Aeq},16hr, and during the night time, noise levels of 30dB L_{Aeq},8hr.

In addition to the above, BS8233 also states that where development is considered desirable or necessary then despite external noise levels exceeding these guidelines, the internal target may be relaxed by up to 5dB and 'reasonable' conditions can still be achieved.

The standard also reiterates the fact that it is desirable that noise levels in outdoor amenity areas such as gardens and balconies do not exceed 50dB $L_{Aeq,T}$ and that 55dB $L_{Aeq,T}$ should be regarded as the upper limit. However it also states that this may not be achievable in some areas, such as city centres, and that a compromise between noise and the convenience of living in these areas can be met.

2.5 WHO Night Noise Guidelines for Europe - 2009

The WHO Night Noise Guidelines for Europe have published guidelines for night time noise based upon exposure effects relationships which take into account the effects of noise on public health and wellbeing when sleeping.

The night noise guideline values are recommended for the protection of public health from night noise and are shown below in Table 2.

Table 2 WHO recommended night noise guidelines for Europe

Guideline	Noise level
Night noise guideline (NNG)	$L_{night,outside}$ 40dB(A)
Interim Target (IT)	$L_{night,outside}$ 55dB(A)

For the primary prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than 40dB(A) of $L_{night,outside}$ during the part of the night when most people are in bed.

The lowest observed adverse effect level (LOAEL) of night noise, 40dB(A) $L_{night,outside}$, can be considered a health based limit value of the night noise guidelines (NNG) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise. An interim target (IT) of 55dB(A) $L_{night,outside}$ is recommended in the situations where the achievement of NNG is not feasible in the short term for various reasons.

It should be noted that the interim target is not a health-based limit value by itself. Vulnerable groups cannot be protected at this level. Therefore, the interim target should be considered only as a feasibility-based intermediate target which can be temporarily considered by policy-makers for exceptional local situations.

2.6 WHO Guidelines for Community Noise - 1999

The WHO Guidelines for Community Noise also consider the impact of night-time exposure to noise and sleep disturbance, such that if negative effects on sleep are to be avoided, the equivalent sound pressure level ($L_{Aeq,8hr}$) should not exceed 30dB indoors for continuous noise.

If the noise is not continuous, sleep disturbance correlates best with L_{Amax} and effects have been observed at 45dB or less. These guidelines state that this is particularly true if the background level is low. Noise events exceeding 45dB(A) should therefore be limited if possible.

The document also states that 10 to 15 occurrences per night that exceed the limiting L_{Amax} external noise level of 45dB may be considered acceptable.

For sensitive groups, an even lower limit would be preferred but this value is not specified. It also declares that it should be possible to sleep with a bedroom window slightly open (resulting in a reduction of 15dB(A) from outside to inside). To prevent sleep disturbances, the equivalent sound pressure level and the number and level of sound events should be considered.

Mitigation targeted to the first part of the night is believed to be effective for the ability to fall asleep.

The WHO Guidelines for Community Noise are considered to be complimentary to the WHO Night Noise Guidelines for Europe.

2.7 British Standard BS4142:2014+A1:2019

British Standard BS4142 is normally used to assess the impact of industrial and commercial sound, by means of determining the influence that such sound may have on 'normal' background levels. It covers a range of methods allowing the assessor to decide what level of detail may be appropriate, and also allows adjustments to be made for features such as tonal noise and impulsive sounds.

The standard supports current UK planning guidance and Environment Agency requirements on noise impact assessments; however it is also not deemed to be appropriate for this current assessment due to the fact that the dominant noise is expected to be vehicle related.

3 Site characteristics

The activities on the site are principally those involved with the preparing, packing, storage and distribution of vegetable produce.

The site is essentially in use throughout a full 24 hour period, 7 days per week, during which time heavy vehicles will enter the site for loading and unloading. It is also understood that on some occasions these may park up with their engines running and/or trailer refrigeration units operating.

Lorry parking is generally confined to a designated area which has been designed to minimise sound propagation towards Pagham Road, however it is also understood that they may sometimes park in other more convenient areas on the site during the night-time.

There is no other industry of significance located in this area within a radius of 500m from the AD plant.

In considering this, the principal source of noise would appear to relate to the movement of heavy vehicles and forklift trucks. As implied above, the heavy vehicles can potentially enter or leave the premises and yard at any time of the day; although the busiest period for vehicular movement tends to be mid-morning and early evening.

A large amount of the 'noisy' activity takes place within the aforementioned yard, which is currently at the rear (west) of the main packing house. It exists as a large open area with concrete surface cover.

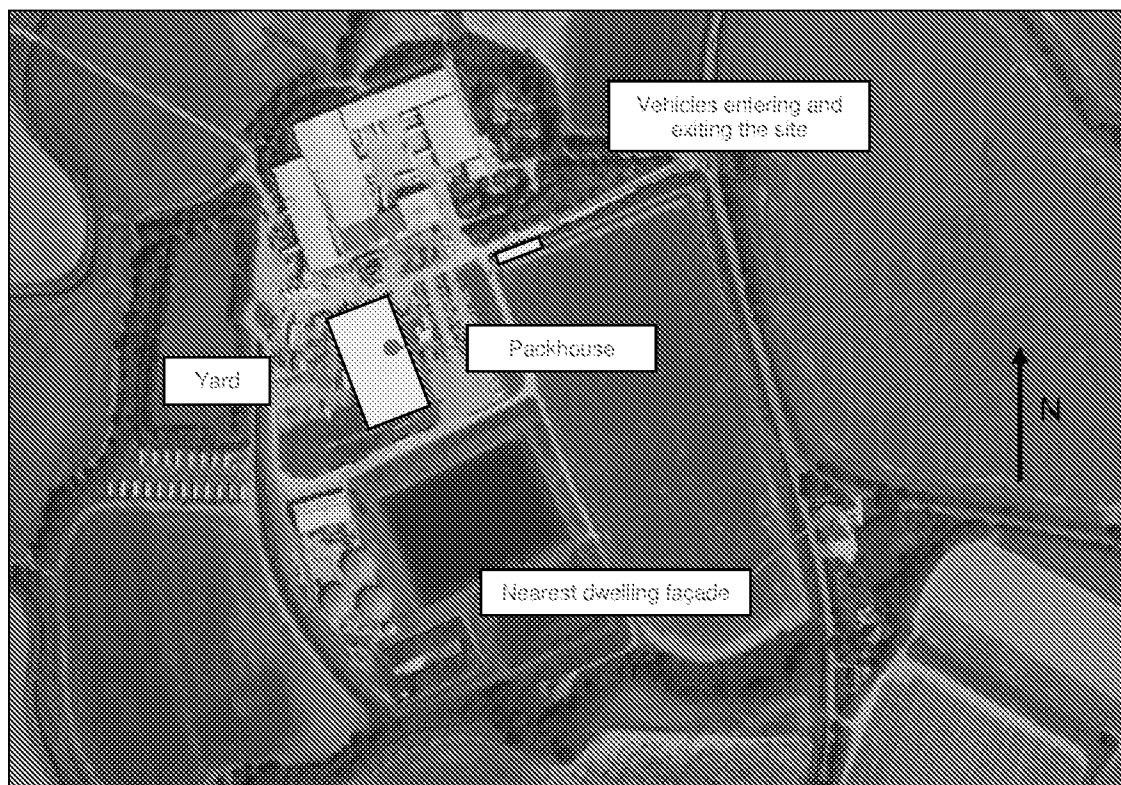
As stated, the proposal is to construct a new packhouse building to the east of the existing packhouse; effectively bringing the site activity closer towards the road. This in turn would bring the yard area closer to Pagham Road and any nearby off-site residential receptors, although the future loading and unloading activity within the yard should be almost entirely screened from Pagham Road by the new building itself.

The second principal area of 'noisy' activity is the access road leading onto the site from Pagham Road to the east, which is where heavy vehicle movement will be at its greatest; as the vehicles enter and exit the site throughout the day and night.

With regards to off-site residential receptors, it is understood that the two dwellings to the immediate north of the subject site are associated with the site itself, whereas other than these the closest dwelling is Old Sefter School House which is located on Pagham Road at its junction with Sefter Road, and lies around 300m to the southeast of the subject site access drive and 400m to the southeast of the current yard area. It has been noted on both this and previous occasions that Pagham Road and Sefter Road appear to have a steady stream of traffic during the day-time, and to a much lesser degree during the night-time.

These above features have been noted on the aerial photograph below, Figure 1.

Figure 1 Current site layout and features



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The basic objectives of this exercise therefore are as follows:

- to measure the existing sound pressure levels at the barrier position upon entry into or exit from the site throughout a full 24-hour period;
- to measure the existing sound pressure levels within the current yard area at the rear of the pack house throughout a full 24-hour period; and
- to provide baseline sound levels to assist in any future assessments for the determining of off-site impacts.

4 Sound level monitoring

The sound level monitoring for this assessment was undertaken from 12.00H on Thursday 27th May 2021 through to 13.00H on Friday 28th May 2021.

In doing so, two Cirrus Optimus CR:171B Type I integrating sound level meters were used. Each meter was calibrated both prior to, and after use at 94dB using a Cirrus CR:515 acoustic calibrator. The instrument details have been reproduced below in Table 3.

Table 3 Sound level instrumentation used

Equipment	Description	Serial No.
Cirrus Optimus CR:171B	Class 1 sound level meter with 1/3 octave frequency analyser	G068532
Cirrus Optimus CR:171B	Class 1 sound level meter with 1/3 octave frequency analyser and tonal detection capability	G068504
Cirrus Acoustic Calibrator CR:151	IEC 60942.2003 Class 1 calibrator	70846

For the purposes of obtaining representative sound level measurements at the site entrance/exit barrier, the sound level meter was positioned on top of the security cabin, at a height of around 2.5m above ground level, and therefore immediately adjacent to a vertical reflective surface below the microphone. Similarly the instrument was positioned on a horizontal surface; namely the roof of the cabin, which may also have exhibited some degree of reflection. The impact of any reflection has been considered below in Section 5.1.

For the purposes of obtaining representative sound level measurements in the yard area, the sound level meter was positioned on top of a metal projection above cooling plant, at a height of around 4m above ground level. In this location there was a small area of adjacent vertical reflective surface below the microphone, in addition to the horizontal metal surface upon which the instrument was positioned; and therefore again there may have been some degree of reflection from these surfaces. This has also been considered below in Section 5.1.

The measurement location at the barrier has been identified as N.01, for which the instrument position has been indicated below in Figure 2, and shown in Photograph 1. There was a clear line of sight to the driveway, with the instrument located around 4m from any vehicle entering the site, and around 8m from vehicles exiting the site.

The measurement location at the yard has been identified as N.02, for which the instrument position has also been shown in Figure 2, and in Photograph 2. There was a clear line of sight to most parts of the yard, with the instrument located around 20m from the centre position.

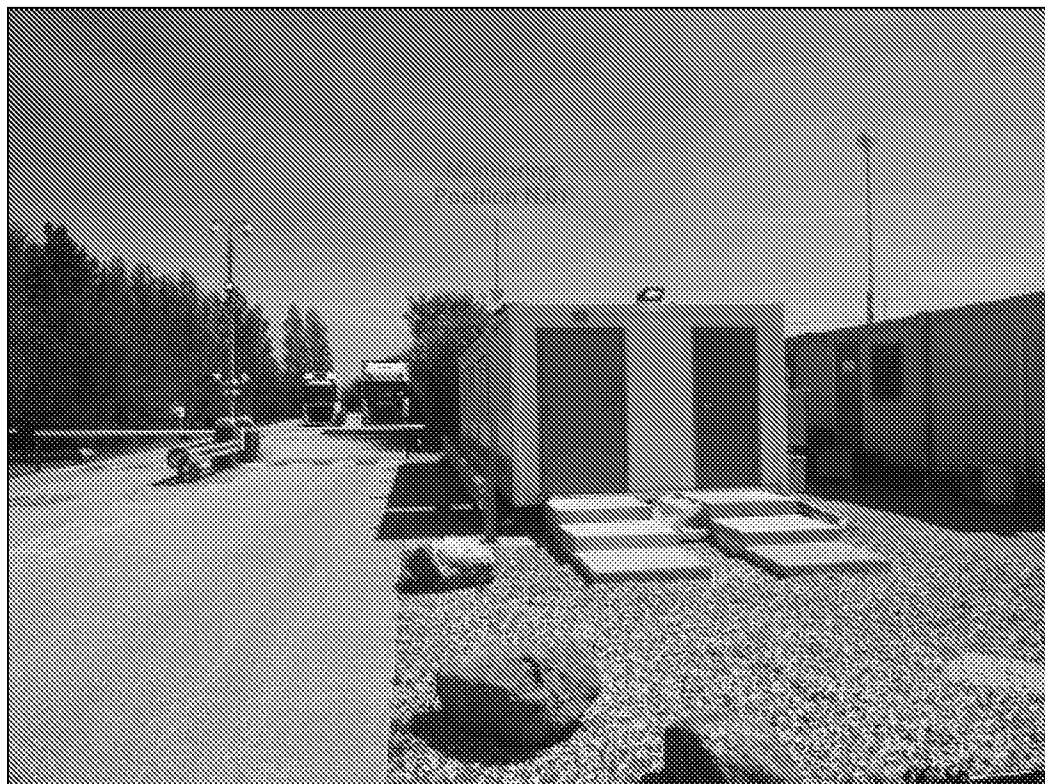
In each instance the instrument microphone was secured horizontally with the diaphragm held in a vertical position.

Figure 2 Showing the approximate sound level instrument position



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Photograph 1 Showing the sound level instrument in position N.01 (barrier)



Photograph 2 Showing the sound level instrument in position N.02 (yard)



Whilst in attendance at the site the dominant sounds were vehicle-related; namely engines including the occasional release of compressed air; in addition to which there was fairly consistent bird song and occasional voices.

The weather conditions were generally favourable for monitoring, namely dry with no rainfall, and warm (11 - 14°C) with only a very light wind (0.5 - 3.6m/s) mainly coming from a southerly direction. The conditions have been reproduced below in Table 4.

It was noted that the wind direction is likely to have brought road noise from Pagham Road on to the site, thereby quite possibly elevating the overall site noise levels; however it can be argued that this may be entirely representative of the situation at the site.

Table 4 Weather conditions throughout the measurement period

Date and Time	Mean temperature	Rainfall total	Mean wind direction	Mean wind speed
Thursday 27.05.2021 12.00 - 15.00H	14°C	0.0mm	SSW	3.6m/s
Thursday 27.05.2021 15.00 - 18.00H	14°C	0.0mm	SSW	3.3m/s
Thursday 27.05.2021 18.00 - 21.00H	14°C	0.0mm	SW	2.2m/s
Thursday 27.05.2021 21.00 - 00.00H	12°C	0.0mm	E	0.8m/s
Friday 28.05.2021 00.00 - 03.00H	11°C	0.0mm	NW	0.8m/s
Friday 28.05.2021 03.00 - 06.00H	11°C	0.0mm	NNE	0.8m/s
Friday 28.05.2021 06.00 - 09.00H	12°C	0.0mm	E	0.5m/s
Friday 28.05.2021 09.00 - 12.00H	14°C	0.0mm	SE	1.6m/s
Friday 28.05.2021 12.00 - 15.00H	14°C	0.0mm	SSE	2.2m/s

5 Monitoring results

5.1 Barrier position monitoring

The sound levels obtained for a position to the immediate south of the yard have been reproduced below in Table 5.

These have been divided up into day-time readings and night-time readings, although as the monitoring was undertaken from around noon on the 27th May through to around noon on the 28th May, the day-time readings are shown as Day-time 1 (12.30 to 23.00H on the 27th May) and Day-time 2 (06.00H to 12.30H on the 28th May). The night-time readings are from 23.00 on the 27th May to 06.00H on the 28th May

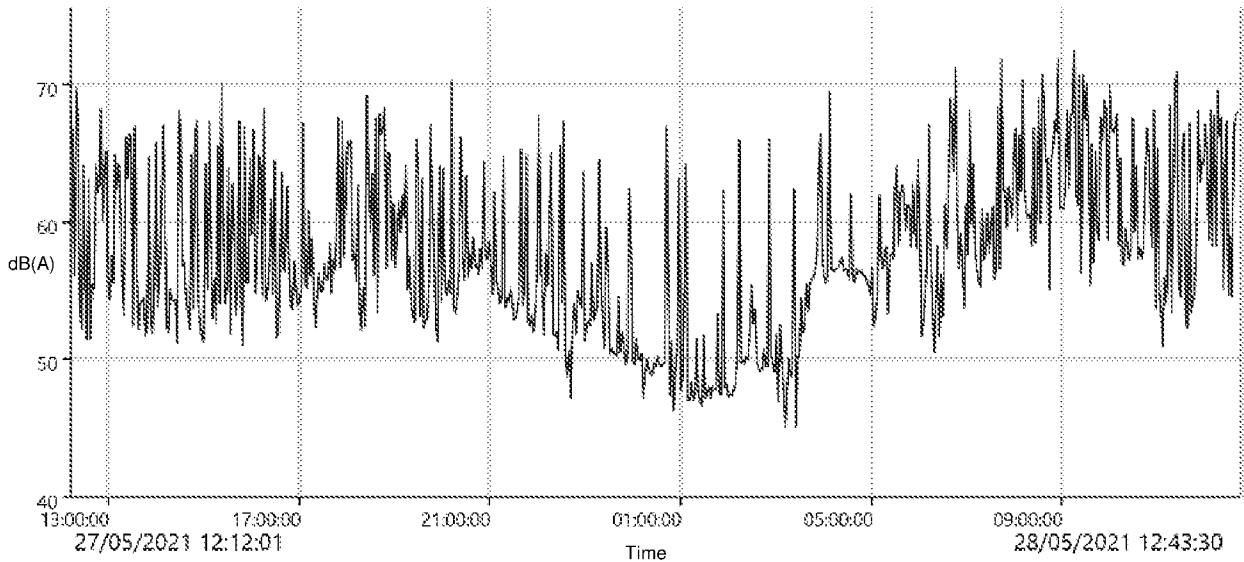
As discussed above, it is expected for the measured results to have been enhanced by possibly two planes of reflection; namely the metal side wall and roof of the structure supporting the instrument. Despite this, reflection from just one plane is being considered, and therefore all measured results have been adjusted downwards by 3dB to account for this effect.

Table 5 Sound level readings throughout the working day at position N.01 (barrier position)

Parameter	Day-time 1	Night-time	Day-time 2
	12.30H - 23.00H /dB	23.00 - 06.00 /dB	06.00H - 12.30H /dB
L _{Aeq}	58.4	55.3	61.6
L _{Amax}	88.2	84.8	92.9
L _{A1}	72.2	68.1	75.6
L _{A5}	64.0	60.8	68.0
L _{A10}	60.4	58.8	64.5
L _{A50}	51.1	48.7	55.8
L _{A90}	48.5	44.8	49.4
L _{A95}	48.1	44.3	48.1
L _{A99}	46.9	42.1	46.3

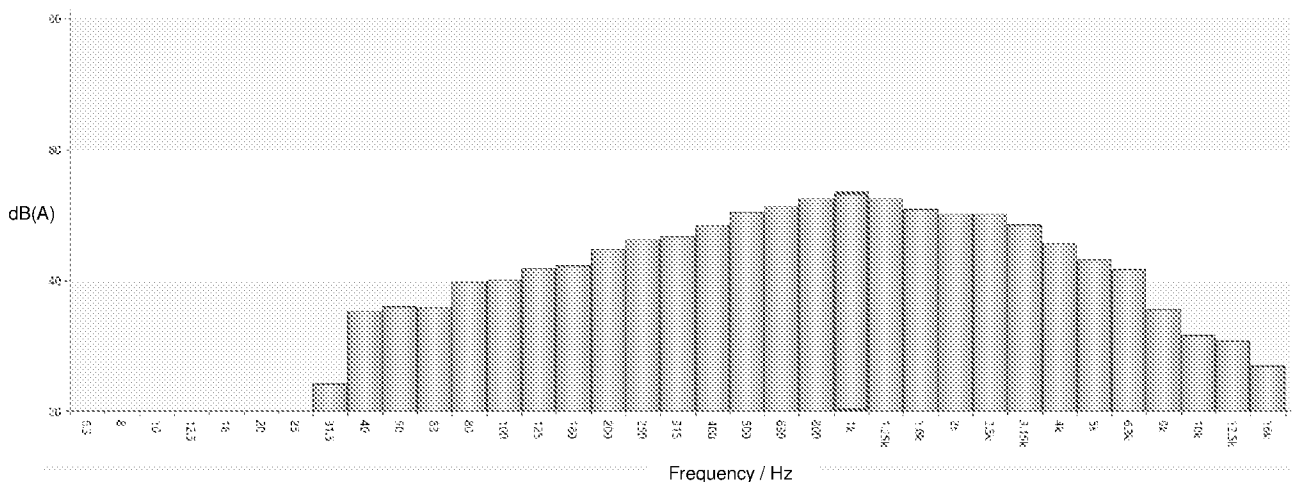
A profile showing the $L_{Aeq(T)}$ trend throughout the continuous monitoring period has been reproduced below in Graph 1. Additionally a one-third octave band analysis has also been obtained from this same period, and reproduced below in Graph 2.

Graph 1 L_{Aeq} measurement profile over the entire measurement period at N.01 (barrier)



Through reference to Graph 1 above it can be seen that although the sound level fluctuated throughout the day, the L_{Aeq} seems to largely remain within the 50dB to 70dB range. It is also noted that site activity (presumed vehicle movement) continued throughout the evening and night-time.

Graph 2 A-weighted 1/3 octave band profile for the entire measurement period at N.01 (barrier)



Through reference to Graph 2 above, the dominant frequency was 1kHz, with an almost symmetrical curve. This does not seem to suggest that there are any features of concern other than vehicles. It is also apparent from this profile that there was no evidence of tonality.

5.2 Yard position monitoring

The sound levels obtained at a position on the southeastern edge of the yard have been reproduced below in Table 6. Once again the readings may well have been impacted by two planes of reflection; namely the metal roof of the structure upon which the instrument was located, and the section of steel facing immediately below the microphone. Again however, the results have only considered reflection from a single plane, in order to consider a possible worst-case situation. The readings have therefore been reduced by 3dB accordingly.

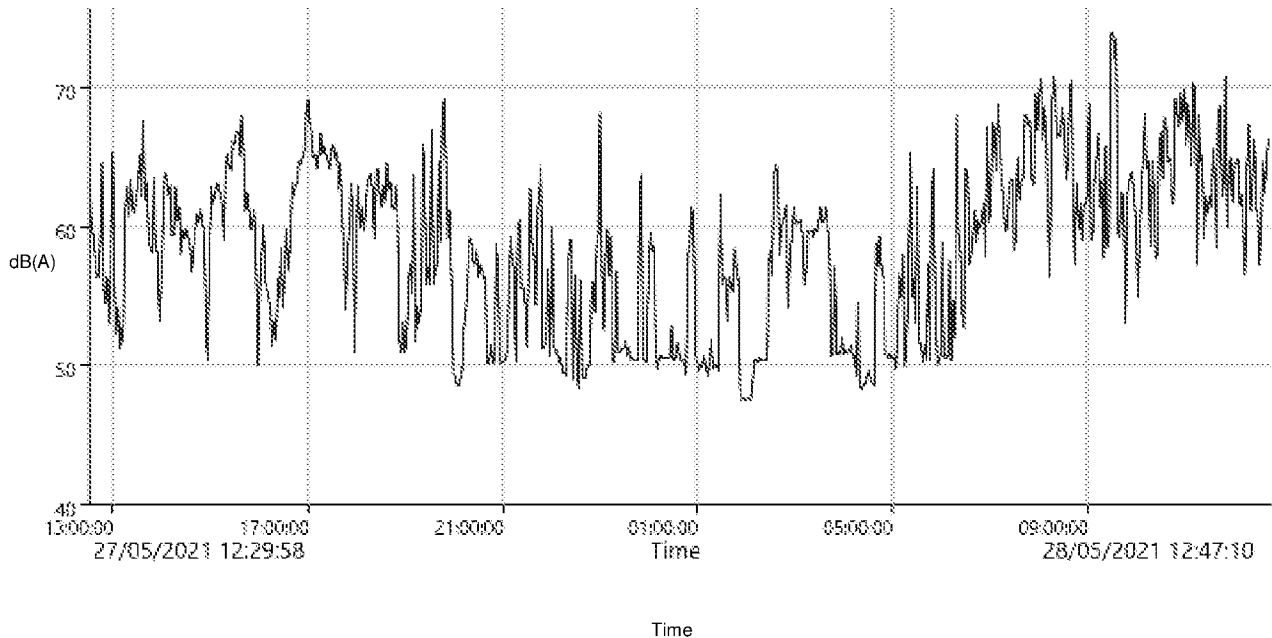
As before, these have been divided up into Day-time 1 (12.30 to 23.00H on the 27th May) and Day-time 2 (06.00H to 12.30H on the 28th May). The night-time readings are from 23.00 on the 27th May to 06.00H on the 28th May.

Table 6 Sound level readings throughout the working day at position N.02 (yard area)

Parameter	Day-time 1	Night-time	Day-time 2
	12.30H - 23.00H /dB	23.00 - 06.00 /dB	06.00H - 12.30H /dB
L _{Aeq}	58.1	53.9	62.4
L _{Amax}	86.6	81.4	91.3
L _{A1}	72.5	66.4	78.2
L _{A5}	66.7	59.8	71.3
L _{A10}	63.9	57.8	67.9
L _{A50}	53.0	48.2	57.3
L _{A90}	47.3	46.5	49.8
L _{A95}	46.7	45.8	48.8
L _{A99}	45.5	44.7	47.5

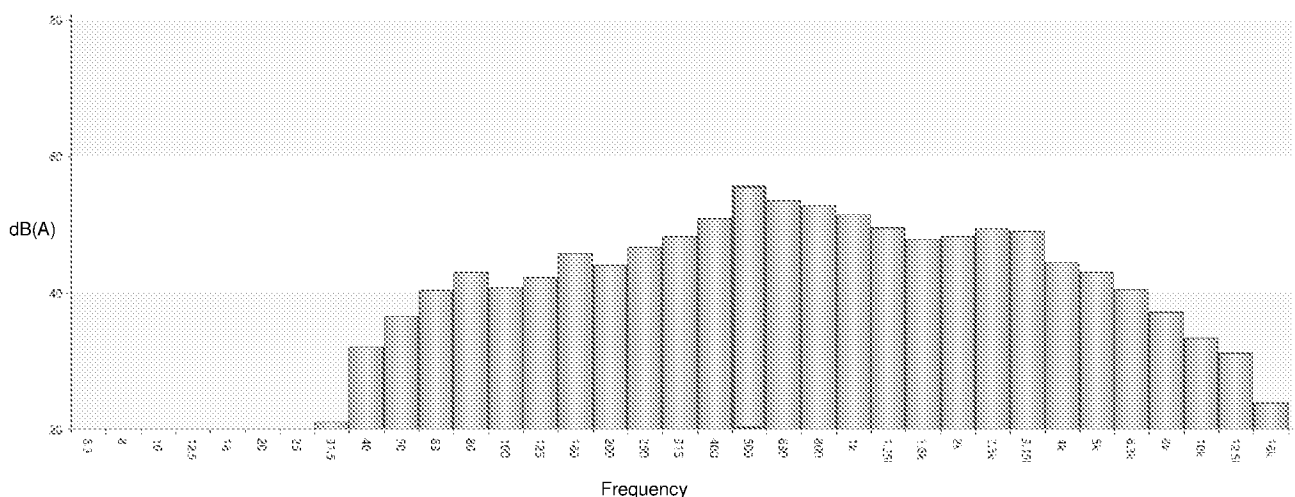
A profile showing the $L_{Aeq(T)}$ trend throughout the continuous monitoring period has been reproduced below in Graph 3. Additionally a one-third octave band analysis has also been obtained from this same period, and reproduced below in Graph 4.

Graph 3 L_{Aeq} measurement profile over the entire measurement period at N.02 (yard area)



Through reference to Graph 3, once again the L_{eq} tended to lie within the 50dB to 70dB range, and it also suggests that the majority of the yard activity appeared to occur during the morning period from around 6.30am through to 11.00am.

Graph 4 A-weighted 1/3 octave band profile for the entire measurement period at N.02 (yard area)



Through reference to Graph 4 above, the dominant frequency was 500Hz, showing a less defined curve, suggesting that the noise in this area may come from a number of different activities or sources .

5.3 Results summary

As discussed above, it is expected that the movement of vehicles within or moving past these two assessed areas will be the principal source of noise.

The assessment has considered the ambient noise over two day-time periods, and one night-time period. For the purpose of this assessment therefore, the two day-time measurements periods have been combined to obtain a single mean day-time sound pressure level, whereas the night-time sound level has been obtained directly from the single period of night-time monitoring.

Therefore, with regards to Position (N.01) immediately adjacent to the entrance barrier there was a day-time $L_{eq(06.00-23.00)}$ of 60dB(A) and a night-time $L_{eq(23.00-06.00)}$ of 55dB(A).

With regards to Position (N.02) at the eastern boundary of the main yard, there was a day-time $L_{eq(06.00-23.00)}$ of 60dB(A) and a night-time $L_{eq(23.00-06.00)}$ of 54dB(A).

It has been estimated that the distance from position N.01 to the centre of the access driveway is around 6m, whereas the distance from position N.02 to the centre of the yard is around 20m.

As the dominant noise appears to be a mobile source, namely traffic moving around the site, this would normally be regarded as line source noise. However as the vehicle activity in the yard tends to be confined within a small area, it could be more realistic to consider this as a point source; with the whole yard being the 'point' or origin. Despite this, by considering all site noise as a line source this should at least provide a worst-case assessment.

Using the day-time and night-time L_{eq} values obtained at position N.01 immediately adjacent to the barrier, the expected sound pressure level (L_2) at a distance of 1m from the centre of the barrier can be calculated using:

$$L_2 = L_1 - (10\log(r_2/r_1))\text{dB}$$

Where L_1 is the measured L_{eq} at position N.01, r_2 is 1m, and r_1 is the distance from the measurement position to the central point; hence:

- during the day-time: $L_2 = 60 - (10\log(1/6)) = \underline{68\text{dB(A)}}$
- during the night-time: $L_2 = 55 - (10\log(1/6)) = \underline{63\text{dB(A)}}$

For the purposes of undertaking this assessment therefore the day-time sound pressure level 1m from the centre of the access driveway (expressed as the L_{eq}) has been calculated as 68dB(A) and the corresponding night-time level has been calculated as 63dB(A).

Using the day-time and night-time L_{eq} values obtained at position N.02 adjacent to the yard, the expected sound pressure level (L_2) at a distance of 1m from the centre of the yard can be calculated using:

$$L_2 = L_1 - (10\log(r_2/r_1))\text{dB}$$

Where L_1 is the measured L_{eq} at position N.02, r_2 is 1m, and r_1 is the distance from the measurement position to the central point; hence:

- during the day-time: $L_2 = 60 - (10\log(1/20)) = \underline{73\text{dB(A)}}$
- during the night-time: $L_2 = 54 - (10\log(1/20)) = \underline{67\text{dB(A)}}$

For the purposes of undertaking this assessment therefore the day-time sound pressure level 1m from the centre of the yard (expressed as the L_{eq}) has been calculated as 73dB(A) and the corresponding night-time level has been calculated as 67dB(A).

6 Determination of sound impact at the nearest receptors

6.1 Current impact

The impact that the yard noise is expected to be currently having on the nearest dwelling can be theoretically calculated using the same above equation. In doing so, the noise is still considered to be a line source in order to provide a worst-case outcome.

Using the sound levels calculated from position N.01 (adjacent to the barrier), where the day-time and night-time sound levels were 68dB(A) and 63dB(A) respectively at a reported distance of 300m from the nearest dwelling façade:

- during the day-time: $L_2 = 68 - (10\log(300/1)) = \underline{43\text{dB(A)}}$
- during the night-time: $L_2 = 63 - (10\log(300/1)) = \underline{38\text{dB(A)}}$

In actuality, as the dwelling is screened from the noise source by vegetation and other features over the 300m distance, it is not unreasonable to believe that this could attenuate the noise by at least 5dB, suggesting that a more realistic day-time and night-time façade sound level at that dwelling could be in the region of 38dB(A) and 33dB(A) respectively.

Using the sound levels calculated from position N.02 (adjacent to the yard), where the day-time and night-time sound levels were 73dB(A) and 67dB(A) respectively at a reported distance of 400m from the nearest dwelling façade:

- during the day-time: $L_2 = 73 - (10\log(400/1)) = \underline{47\text{dB(A)}}$
- during the night-time: $L_2 = 67 - (10\log(400/1)) = \underline{41\text{dB(A)}}$

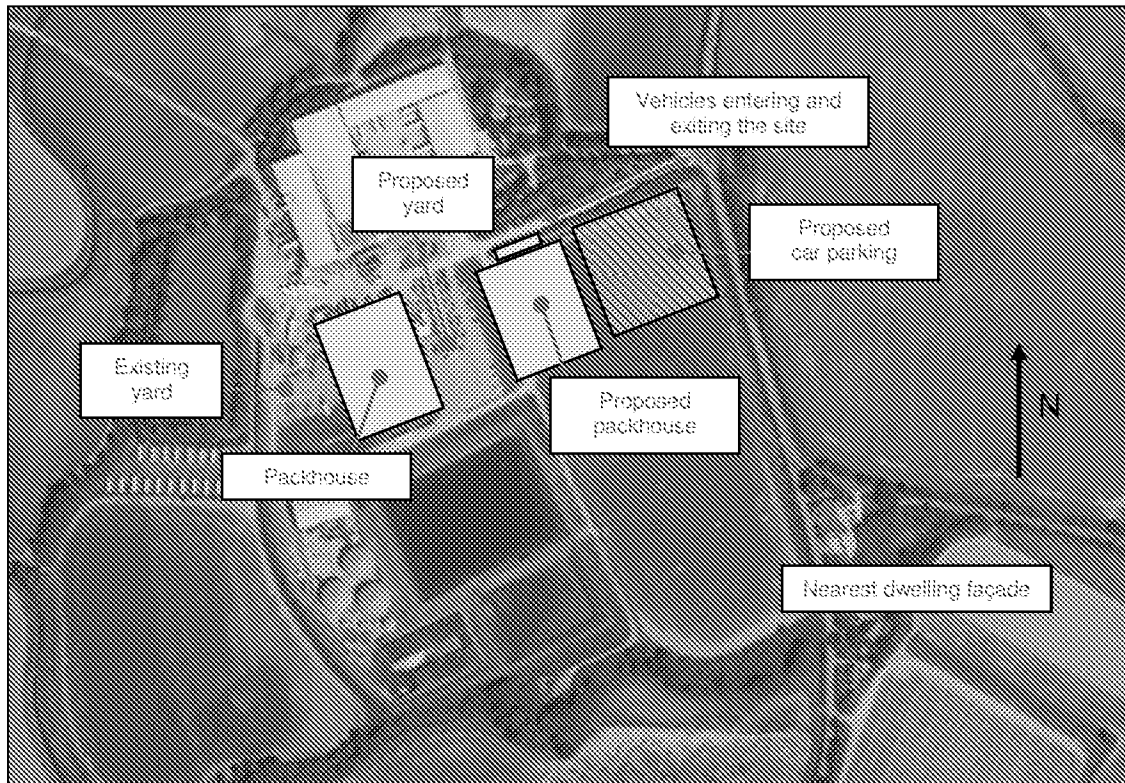
In actuality, the dwelling in this instance is largely screened from the yard noise by the existing packhouse, as well as vegetation and other features over the 400m distance.

As such it is not unreasonable to believe that this could attenuate the noise by at least 10dB, although taking a precautionary approach a 5dB reduction will be considered, suggesting that a more realistic day-time and night-time façade sound level at that dwelling could be in the region of 42dB(A) and 36dB(A) respectively.

6.2 Future impact

In considering the proposed changes at the site; the most significant of which is likely to be the moving of the yard eastwards, this will not only bring the yard activity closer to the aforementioned nearest dwelling, but in doing so the new building will only partially screen the yard from the dwelling, as indicated in Figure 3 below.

Figure 3 Proposed site layout and features



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It is estimated that the distance from the yard to the dwelling would be shortened to around 250m, whereas the distance from the access drive to the dwelling should remain as before at around 300m.

There is little to suggest that the noise within the yard will alter significantly, and therefore it seems valid to reuse the same sound levels as used previously to determine the impact at the dwelling; namely day-time and night-time sound levels of 73dB(A) and 67dB(A) respectively, albeit in this instance at a reported distance of 250m from the dwelling façade:

- during the day-time: $L_2 = 73 - (10\log(250/1)) = \underline{49\text{dB(A)}}$
- during the night-time: $L_2 = 67 - (10\log(250/1)) = \underline{43\text{dB(A)}}$

Despite the proposed building only likely to partially screen the yard from the dwelling, it should still provide some degree of screening, which along with the other aforementioned features in-between, is still expected to offer at least a 5dB reduction on the calculated values, suggesting more realistic day-time and night-time façade sound levels in the region of 44dB(A) and 38dB(A) respectively.

It is however been suggested above that this may have over-estimated the expected impact at the dwelling, as the yard noise could potentially be considered as a point source, due to the fact that vehicles here may spend more time manoeuvring, or sitting with engines idling than driving past.

If this were the case then the calculation would be more appropriate if the 20log factor was used, whereby:

- during the day-time: $L_2 = 73 - (20\log(250/1)) = \underline{25\text{dB(A)}}$
- during the night-time: $L_2 = 67 - (20\log(250/1)) = \underline{19\text{dB(A)}}$

In actuality it is suggested therefore that the impact that the yard noise should be having at that dwelling is likely to be somewhere in-between these calculated values, hence:

- a day-time impact of somewhere between 25dB(A) and 44dB(A)
- a night-time impact of somewhere between 19dB(A) and 38dB(A).

7 Evaluation against guideline criteria

This report has attempted to assess the impact that the subject site should have on a single residential receptor currently around 300m from the subject site access driveway, and around 400m from the current main yard area, for which reference can be made to BS8233:2014 regarding acceptable sound exposure levels both within the dwelling and the external recreational areas.

For this purpose BS8233:2014 suggests that the sound level in external recreation areas should ideally not exceed 50dB(A), whereas the corresponding internal level during the day-time should ideally be 35dB(A) or less, and the night-time level should be 30dB(A) or less; in order to provide a 'good standard of living'.

In making this assessment it is expected for any solid building fabric and closed double-glazed window to offer a sound reduction of at least 25dB, and for a partially open double-glazed window to be able to offer a sound reduction of at least 12dB.

In considering all of the above, Table 7 below details the expected internal and external sound exposure level for this receptor, both currently and expected; where the centre of the yard has been considered as the source of noise, and it has been considered to behave as a line source. In any instance where the corresponding criteria do not appear to be met, the value has been shown in red.

Table 7 Predicted broadband noise exposure levels expressed as the Leq - dB(A)

Receptor	External	BS8233 Criteria	Internal with windows closed	BS8233 Criteria	Internal with window partially open	BS8233 Criteria
Dwelling during the day-time as current	47	50	<30	35	<35	35
Dwelling during the night-time as current	41	50	<30	35	<35	30
Dwelling during the day-time as proposed	49	50	<30	30	37	35
Dwelling during the night-time as proposed	43	50	<30	30	31	30

In considering the estimated exposure levels shown within Table 7 above, it would appear that there could be a possibility that the proposed moving of the yard could impact the closest dwelling internally during the day-time and night-time whenever there is a window open.

More specifically, the calculations have suggested that the day-time internal sound levels could marginally exceed the 35dB criteria by just 2dB, when a window is partially open; and by just 1dB during the night-time.

In considering this further, as stated above it is expected for this assessment to have provided a worst-case outcome, on the basis of two factors.

Firstly, it has considered the noise within the yard area as a line source, whereas in reality it may be more characteristic of a point source. If the latter were to be used the impact at the dwelling would be significantly lower, and well below the guideline criteria.

Secondly the assessment has only considered partial screening of noise from both the yard and the access driveway by applying a 5dB reduction, whereas in reality there are numerous features that could reflect, absorb or attenuate the noise as it propagates over distances of 250m to 400m, thereby suggesting that a reduction approaching 10dB may be more appropriate. Again, even an increase of just 2dB in the reduction of noise over this distance would be enough to comply with the quoted guideline criteria.

8 Summary and recommendations

8.1 Summary of findings

This report has concluded that the proposed moving of the yard area further to the east could potentially impact the nearest dwelling. More specifically, guideline criteria relating to internal noise exposure could be exceeded marginally during both the day-time and/or night-time.

In reaching this conclusion a number of presumptions have been made; each of which could have a potentially significant bearing on the results. These are as follows.

Firstly it is presumed that the sound will behave as a line source, and that the constructed and natural topographical features will only reduce the calculated sound levels as they propagate towards the receptor by 5dB, whereas the likelihood is that this value would be higher.

In considering this it has been suggested that this report has over-estimated the situation in order to provide a worst-case situation. In actuality the impact is expected to be significantly lower than that which has been concluded, such that there is a very strong probability that the British Standard guideline criteria should generally be met internally within the dwelling.

Secondly it has been presumed that the noise at the subject site is the only noise affecting the highlighted receptor, whereas in actuality the dwelling is located on a busy local road, at a junction with a second local road. As a consequence, there is a realistic possibility that noise from the traffic using these roads could be having more of an impact at the dwelling.

Thirdly it is recognised that little consideration has been given to any future increase in vehicle numbers entering and exiting the site once the alterations have been made; however as stated, the belief at this stage is that the number of heavy vehicle movements will not alter significantly, although there could be an increase in light vehicle usage upon the site - particularly between the packhouse and the proposed packhouse.

8.2 Recommendations

In view of these findings, and the highlighted uncertainty - particularly with regard to on-site vehicle movement, it is recommended that once the alterations have been made at the site then the sound levels should be monitored once more, and the impact to any sensitive off-site receptors reassessed.

9 Uncertainties

In undertaking the sound level measurements for this assessment a number of uncertainties were potentially present, although in all instances efforts were made to minimise or eliminate such.

It has already been highlighted within this report that presumptions have been made regarding the precise source position of the site noise, and the extent to which some of the existing features will be attenuating or reflecting noise away from the discussed receptors.

With regards to other uncertainties, in the first instance, the nature of activities occurring in the yard area will have a high degree of potential variability; whereas for the purposes of this current assessment the presumption has been made that measurements were obtained under both typical and future working conditions.

Secondly, the influence from the weather can invariably be significant; hence the sound exposure level at the façade of any receptor can be highly variable from day to day. In this specific instance the measurements were obtained throughout a dry, very light wind period with the impact at the receptor being calculated mathematically (under ideal environmental conditions).

As a consequence the wind could potentially have been influential with regards to the outcome of the assessment by means of drawing road noise onto the site; although there will inevitably be occasions when these conditions will be replicated, just as there will be days when these conditions will not be evident. It is therefore noted that the sound impact at the closest receptor will presumably be less on some days than reported herein, just as it may well be greater on other days.

In considering the latter, it is believed that there is enough difference (in most instances) between the reported sound levels and the guideline levels, to allow for a 'good standard of living' to be maintained under all, or at least under most environmental conditions.

APPENDIX

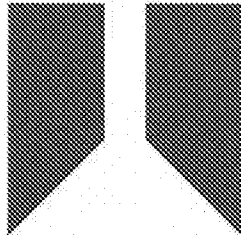
Calibration certification

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 28 October 2020

CERTIFICATE NUMBER 148249



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

S. Doveton

Electronically signed:

Sound Level Meter : IEC 61672-3:2006

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR171B

Serial number: G068532

Class: 1

Firmware version: 2.4.1569

Test summary

Date of calibration: 27 October 2020

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

Periodic tests were performed in accordance with procedures from IEC 61672-3:2006.

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

148249

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 98.87 kPa

Temperature: 21.2 °C

Humidity: 44.6 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TG4001	395851
Attenuator	Cirrus Research	ZE-952	52200
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: Yes

Source of pattern approval: PTB

Preamplifier

Model: MV-200F

Serial number: 4294F

Microphone

Model: MK-224

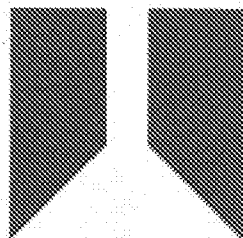
Serial number: 201397A

Test results summary

Test	Result
Internal settings adjustment	Complies
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies

CERTIFICATE OF CALIBRATION

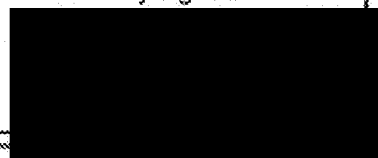
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DATE OF ISSUE 28/10/20 CERTIFICATE NUMBER 148248



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Test engineer:
D.Swatwell
Electronically signed:



Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 201397A

Calibration procedure

Date of calibration: 21 October 2020

Open circuit: 43.2 mV/Pa

Sensitivity at 1 kHz: -27.3 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 98.70 kPa

Temperature: 22.0 °C

Humidity: 56.0 %

CERTIFICATE OF CALIBRATION

Certificate Number:

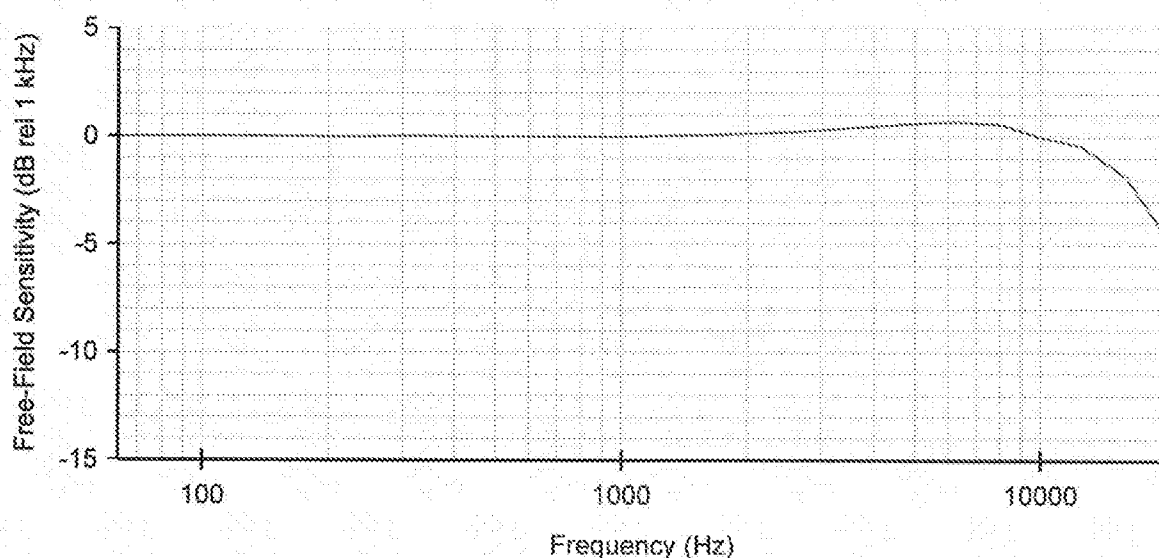
148248

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.00	-0.21
80	0.01	-0.09
100	0.02	-0.04
125	0.01	-0.01
160	0.00	0.00
200	-0.01	0.00
250	-0.02	0.01
315	0.01	0.01
400	-0.01	0.01
500	0.00	0.00
630	0.00	0.00
800	-0.01	-0.02
1 000	0.00	-0.02
1 250	0.03	-0.03
1 600	0.07	-0.05
2 000	0.14	-0.08
2 500	0.21	-0.13
3 150	0.34	-0.24
4 000	0.47	-0.43
5 000	0.60	-0.76
6 300	0.68	-1.39
8 000	0.56	-2.61
10 000	-0.03	-4.66
12 500	-0.46	-6.98
16 000	-1.89	-9.85
20 000	-4.69	-13.81

Free-Field Frequency Response : Graphical

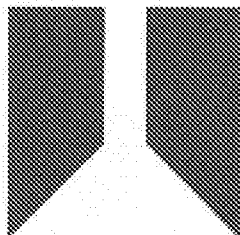


CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 28 October 2020

CERTIFICATE NUMBER 148253



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
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YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

S.Doveton

Electronically signed:



Sound Level Meter : IEC 61672-3:2006

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR171B

Serial number: G068537

Class: 1

Firmware version: 2.4.1569

Test summary

Date of calibration: 27 October 2020

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

Periodic tests were performed in accordance with procedures from IEC 61672-3:2006.

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

148253

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 98.85 kPa

Temperature: 21.3 °C

Humidity: 45.7 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TG4001	395851
Attenuator	Cirrus Research	ZE:952	52200
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: Yes

Source of pattern approval: PTB

Preamplifier

Model: MV:200F

Serial number: 4204F

Microphone

Model: MK:224

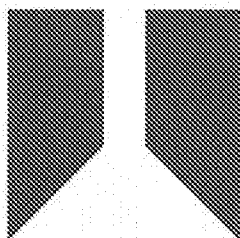
Serial number: 201385A

Test results summary

Test	Result
Internal settings adjustment	Complies
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 28/10/20 CERTIFICATE NUMBER 148252



Cirrus Research plc
Acoustic House
Bridlington Road
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YO14 0PH
United Kingdom

Page 1 of 2

Test engineer:
D.Swalwell
Electronically signed:



Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK.224

Serial Number: 201385A

Calibration procedure

Date of calibration: 21 October 2020

Open circuit: 46.6 mV/Pa

Sensitivity at 1 kHz: -26.6 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 98.70 kPa

Temperature: 22.0 °C

Humidity: 56.0 %

CERTIFICATE OF CALIBRATION

Certificate Number:

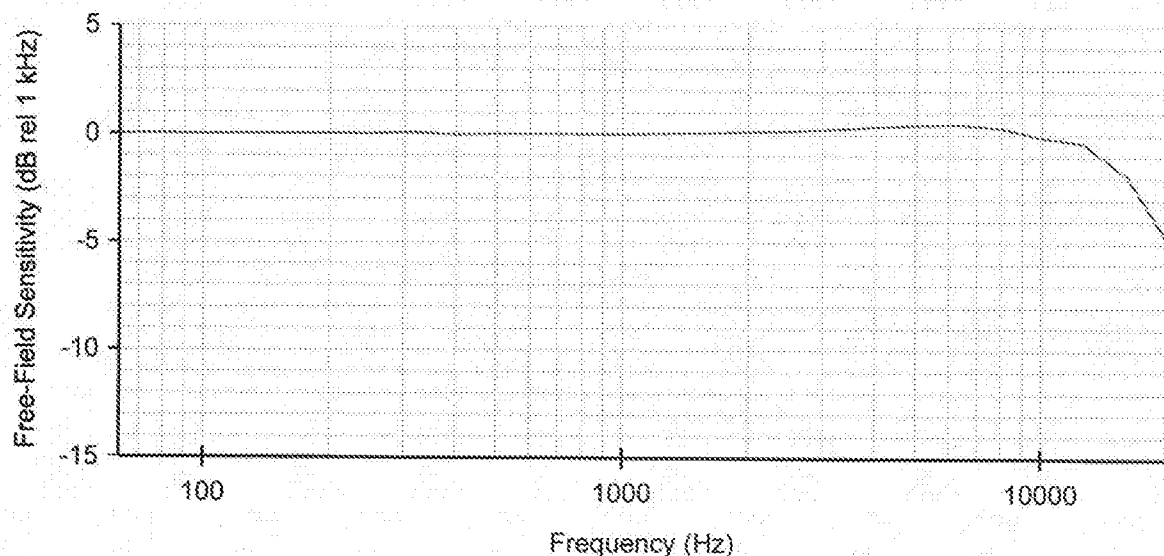
148252

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	-0.01	-0.22
80	0.01	-0.10
100	-0.02	-0.04
125	0.02	0.00
160	0.01	0.02
200	0.01	0.04
250	0.00	0.03
315	0.07	0.08
400	-0.04	-0.02
500	0.00	0.01
630	-0.01	0.00
800	0.00	-0.01
1 000	0.00	-0.02
1 250	0.02	-0.04
1 600	0.07	-0.07
2 000	0.12	-0.11
2 500	0.16	-0.19
3 150	0.25	-0.33
4 000	0.37	-0.57
5 000	0.44	-0.96
6 300	0.49	-1.65
8 000	0.33	-2.89
10 000	-0.13	-4.84
12 500	-0.39	-6.86
16 000	-1.92	-9.77
20 000	-4.90	-13.96

Free-Field Frequency Response : Graphical

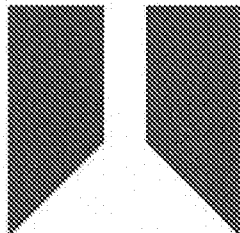


CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 28 October 2020

CERTIFICATE NUMBER 148251



Cirrus Research plc
Acoustic House
Bridlington Road
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Page 1 of 2

Approved signatory

S.Doveton

Electronically signed:



Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:171C

Serial number: G068504

Class: 1

Firmware version: 3.2.2690

Test summary

Date of calibration: 27 October 2020

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

148251

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 98.87 kPa

Temperature: 21.0 °C

Humidity: 44.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY59000875
Attenuator	Cirrus Research	ZE:952	78135
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV:200F

Serial number: 3980F

Microphone

Model: MK:224

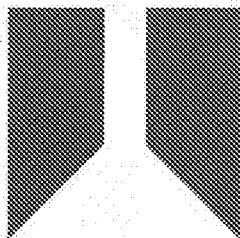
Serial number: 202161A

Test results summary

Test	Result
Internal settings adjustment	Complies
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies

CERTIFICATE OF CALIBRATION

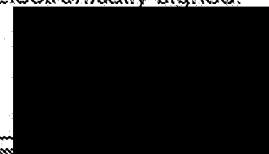
ISSUED BY Cirrus Research plc
 DATE OF ISSUE 28/10/20 CERTIFICATE NUMBER 148250



Cirrus Research plc
 Acoustic House
 Bridlington Road
 Hunmanby
 North Yorkshire
 YO14 0PH
 United Kingdom

Page 1 of 2

Test engineer:
 D. Swatwell
 Electronically signed:



Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK224

Serial Number: 202161A

Calibration procedure

Date of calibration: 21 October 2020

Open circuit: 43.0 mV/Pa

Sensitivity at 1 kHz: -27.3 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 98.70 kPa

Temperature: 22.0 °C

Humidity: 56.0 %

CERTIFICATE OF CALIBRATION

Certificate Number:

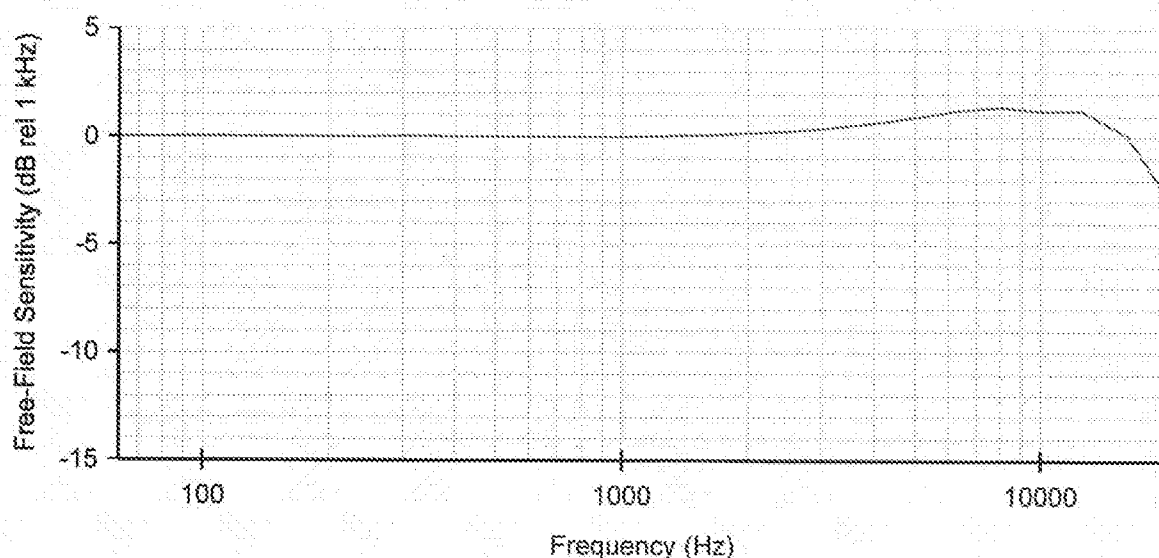
148250

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	-0.01	-0.26
80	0.00	-0.14
100	0.01	-0.09
125	0.00	-0.05
160	-0.01	-0.03
200	-0.01	-0.02
250	-0.02	-0.02
315	0.01	-0.01
400	-0.01	-0.01
500	-0.01	-0.01
630	-0.01	-0.01
800	-0.01	-0.02
1 000	0.00	-0.02
1 250	0.02	-0.03
1 600	0.08	-0.04
2 000	0.16	-0.04
2 500	0.25	-0.05
3 150	0.41	-0.09
4 000	0.64	-0.18
5 000	0.90	-0.35
6 300	1.21	-0.75
8 000	1.38	-1.70
10 000	1.18	-3.52
12 500	1.19	-5.32
16 000	0.07	-7.88
20 000	-2.75	-11.81

Free-Field Frequency Response : Graphical

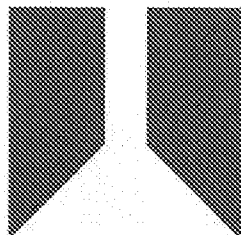


CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **29 October 2020**

CERTIFICATE NUMBER **148254**



**Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom**

Page 1 of 2

Approved signatory

S.Doveton

Electronically signed:

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:515

Serial number: 70846

Class: 1

Test summary

Date of calibration: 27 October 2020

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC 60942:2003 Annex A to Class 1. This has been confirmed with the Physikalisch-Technische Bundesanstalt (PTB).

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

Notes:

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

148254

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 98.75 kPa

Temperature: 20.6 °C

Humidity: 43.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Distortion Meter	Keithley	2015	1113728
Multimeter	Fluke	8845A	1520023

Initial Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Limits	Uncertainty
Level (dB)	94.00	93.87	93.88	93.87	93.87	-0.13	±0.40	0.11 dB
Distortion (%)	< 3.00	0.37	0.37	0.37	0.37	0.37	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.3	1000.3	1000.3	0.3	±10.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Limits	Uncertainty
Level (dB)	94.00	94.00	94.01	94.00	94.00	0.00	±0.40	0.11 dB
Distortion (%)	< 3.00	0.37	0.37	0.37	0.37	0.37	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.3	1000.3	1000.3	0.3	±10.0	0.1 Hz

End of results